THE SURVIVAL OF NATURAL ENVIRONMENT IN WESTERN AUSTRALIA

By J. GENTILLI, Nedlands.

The first large map of land utilization published in Australia* (Atlas of Australian Resources, 1957) shows a large area classified as of "No significant use." A more detailed if much smaller map (Gentilli, 1958) shows the corresponding area as "Unproductive areas, deserts." According to official records, the proportion of the State which was unoccupied in 1960 was 57.1 per cent. Against this, 36.5 per cent was occupied under lease or licence, and 6.4 per eent was alienated or in the process of alienation. The proportion of the State which was unoccupied amounted to 85 per cent in 1900, to 70.5 per cent in 1910, to 55 per cent in 1920 and 1930. After the resumption of part of the marginal agricultural districts and the abandonment of a few pastoral leases the unoccupied area rose to 61.3 per cent in 1940, to reach a new peak of 61.9 per cent in 1951, and fall gradually to the present figure of 57 per cent.

It will be seen that only certain types of natural environment are still unoccupied to any great extent. In the North Kimberleys some 34,000 square miles are unoccupied. It is mostly rocky country, with river flats and some basalt areas, in part reserved for aborigines, in very small part settled by missions, but generally remote from roads, and without any port. The vegetation is "savannah woodland, including monsoon woodland" (Wood†, 1950), "tropical woodland (mixed)" with, especially to the west, patches of "tropical deciduous woodland" and "tropical tree savannah" and especially near the Drysdale River, small areas of "tropical tussock grassland." Dampier Land, which is also unoccupied (part of it is an aborigines' reserve), carries "tropical woodland (mixed)." Perry‡ (1958) simplifies and shows all these areas as "savannah woodland." So does Williams§ (1959) who shows it all as "woodland" with the exception of small "tree and low tree savannah" areas in the west and north.

THE UNOCCUPIED LANDS

By far the largest area of one type of environment which is unoccupied is the desert country, most of which consists of long sand dunes, with the exception of a large stony area in the Gibson Desert. This type of environment occupies 25 to 26 per cent of the State's surface; the little vegetation there is consists of hummocks of *Triodia basedowii* and few other species. To the south-east of Halls Creek are also unoccupied some 6,800 square miles of coun-

* Manuscript maps of land utilization in Australia compiled by W. H. Maze at the University of Sydney and by the writer at the University of Western Australia were never published because of wartime difficulties. A land-utilization map and eight land-utilization profiles of Western Australia were included in the writer's "Atlas of Western Australian Agriculture" (Gentilli, 1941).

† J. A. Wood, late Professor of Botany, University of Adelaide.
‡ R. A. Perry, Principal Research Officer, Ecology and Forest Botany, Division of Land Research and Regional Survey, C.S. & I.R.O.
§ R. J. Williams, Research Officer, Plant Introduction, Division of Plant Industry, C.S. & I.R.O.

try variously defined as "selerophyllous grass steppe" (Wood, 1950), "selerophyll hummock grassland with sclerophyll shrub savannah" (Williams, 1955), "hummoek grassland" (Perry, 1958), "shrub savannah and tussock grassland" (Williams, 1959). Evidently it is a transition between the *Triodia* hummock country to the south and the Pindan *(Acacia* and *Plectrachne schinzii)* shrub savannah to the west. It represents only 0.7 per cent of the State's area.

To the west, the dissected tablelands of the Hamersley complex are also unoccupied, because the terrain is too rugged. The vegetation, where present, is mostly hummocks of *Triodia pungens.* Dale Gorge, which thanks to its isolation, local climate and sheltered drainage, provides an almost unique type of environment, is now a nature reserve.

The western edge of the Great Victoria Desert is also unoccupied. It includes some 30,000 square miles of mixed "mulga scrub and sclerophyllous grass steppe" in part (Wood, 1950), "sclerophyll shrub savannah and semi-arid mallee" (Williams, 1955), "mulga woodland" in part (Perry, 1958), "low layered woodland and semi-arid mallee" (Williams, 1959). In fact, Williams shows that this unoecupied country differs from the eountry further north and further west, which is used for grazing. Wood (1950) showed it as being the same as the country to the north (mulga-*Triodia*), and Perry (1958) as being the same as the country to the west (mulga woodland). The fact that it remains unoceupied shows that it is different, probably in the abundance of *Triodia.*

The narrow belt of country which surrounds the Nullarbor Plain is unoccupied in its northern section, and used for grazing over very small areas to the west and south. Wood (1950) showed the northern edge as "mulga scrub and arid scrub" and the southern and south-western edge as "mallee scrub." On the north-western side mulga is shown as reaching the edge of the Nullarbor Plain. The pattern shown by Williams (1955) is far more complicated: to the north is a very narrow belt of "arid scrub and semi-arid mallee" doubled by a belt of "arid scrub and semi-arid shrub savannah" which around Lakes Gidgi and Jubilee takes over the whole width. West and south of the Nullarbor Plain runs a continuous belt of "arid scrub and semi-arid mallee" which does not reach the coast. The coastal belt consists of "semi-arid mallee."

Perry (1958) simplifies into "drier scrub" to the north of the Nullarbor Plain, "mulga woodland" to the north-west, "mallee" to the south-west and south. Williams (1959) shows a continuous belt of "low layered woodland and semi-arid mallee" not reaching the sea, and a coastal belt of "semi-arid mallee." Pastoral occupation here depends on the availability of water and not on the type of vegetation. The "shrub steppe" of the Nullarbor Plain is entirely unoccupied.

The remainder of the unoccupied country, between the Nullarbor Plain and the agricultural lands, is shown by Wood (1950) as "mallee scrub," with, towards the west, "mallee heath and heath." Williams (1955) shows "semi-arid mallee" as far west as

Lake Cowan, and, north of Kalgoorlie, as far west as Mount Jackson. West of Lake Cowan and south of Mount Jackson he shows a mixture of "semi-arid mallee, heath, temperate woodland." Perry brings the whole area south and west of the Nullarbor Plain as far west as Esperance and Grass Patch under the heading "mallee and heath" to reach the agricultural districts. Williams 1959) shows a continuous coastal belt of heath in the south, but omits heath from the larger "semi-arid mallee-woodland" area.

Typical mallee environment is set aside as a nature reserve at East Pingrup, primarily for the protection of the Mallee Fowl *(Leipoa ocellata)*.

Some 15,500 square miles of country east of a line from Mount Jackson to Youanmi are also unoccupied with the exception of a small enclave. It is mulga scrub, or "arid scrub and sclerophyll shrub savannah" of Williams (1955). The lack of good water on this part of the gneissic plateau, studded with salt lakes, is the reason for its not being utilized.

Fig. 1.—Main classes of modification of the natural environment.

PASTORAL LANDS

Most of the land under lease is used for grazing; pastoral leases cover 208,396,798 acres out of 216,810,793 acres of leased land. Nearly 4 million acres are held under timber permits, and 1 million acres under mining leases. Thus the leased land used for grazing may be estimated at about 209 million acres, or 33.5 per cent of the total (Fig. 1).

To what extent grazing alters the natural environment is somewhat difficult to assess. Generally, native animals are more efficient than sheep in finding food and water; they are much more mobile, do not congregate in large numbers, and have not had their instincts blunted by domestication. Kangaroos and wallabies tend to be very selective feeders, and it is the pastoralists' grievance against them, that they "pick the eye" of pastures, leaving the least palatable plants to the sheep. Feeding by kangaroos, euros and wallabies has been going on from time immemorial; the new factor is the great increase in numbers that has followed the provision of ample quantities of water on the pastoral holdings. With the only predator, the dingo, almost wiped out except in a few inaccessible places (Hamersley Plateau, Great Victoria Desert), the main natural check on population increase has disappeared, and the number of these marsupials has greatly increased. After surveys and experiments, Ealey and Suijdendorp (1959) state that "it is now known that the shrinking flocks have been caused by a deterioration in the pasture vegetation, particularly the disappearance of the more nutritious native grasses on which breeding ewes depended to provide the high-protein diet required for the production and rearing of their lambs. . . . The evidence now available points to the fact that the prime cause of the deterioration of the North-West pastures has been a stocking policy that is unsuited to the climate and conditions, and not to the grazing of euros that have bred up following increased water supply. . . . Moreover, experiments . . . have shown that stocking by sheep alone can quickly produce the pasture changes that have occurred in the region as a whole. . . . On first-year burns . . . one sheep to ten acres consumed all that was produced in the way of palatable forage in the first wet season leaving nothing to produce seed or carry on until the following year."

The plant cover of the overgrazed landscape has been greatly altered, and in some places has been almost wiped out. Wind erosion has appeared where it probably was not previously a factor in the making of the landscape. From the Eastern Goldfields to the Eighty Mile Beach, with the exclusion of the rugged plateaus in the North-West, this is the situation today. We have a detailed study by Wilcox (1960) of the effect of grazing on the Wandarrie grass associations, found "over most of the deeper and sandier soils of the mulga zone. In the ungrazed state the association consists of an upper storey of trees, a middle storey of shrubs and a ground storey of perennial tussocky Wandarrie grasses." Because of the preference shown by sheep for the better growth available in these areas, "in many cases the trees have been killed, the shrubs have

been eaten out and the grass cover consists mainly of Windgrass and Wire Wandarrie grasses."

That even a short period of intensive grazing can affect the environment in a most drastic way has been proved by Wilcox, who had ten acres of degenerate Wandarrie country enclosed against any grazing. At the time of enclosing, Windgrass *(Aristida arenaria)* represented over 70 per cent, Broad Leaf Wandarrie *(Danthonia bipartita)* and Creeping Wandarrie *(Eragrostis lanipes)* 21 per cent of the plants present. After two years of complete protection the composition had changed to Windgrass below 50 per cent and Wandarrie grasses over 50 per cent. Thus some of the effects of grazing are reversible, or at least remediable, but much longer periods may be needed to restore the environment to its natural state.

The area subject to grazing covers the entire "mulga scrub" formation of Wood (1950) called "arid scrub and sclerophyll shrub savannah" by Williams (1955) or "mulga woodland" by Perry (1958) and "low layered woodland" by Williams (1959), with the exception of the core of salt-lake country which remains unoccupied, as mentioned above. The total area is over 200,000 square miles, with considerable variation as to the exact limits, so that it is taken to vary between 20 and 25 per cent of the State's total area according as to what mixed formations are included or not. Wilcox's (1960) Wandarrie country is the best of these mulga formations.

South of the main mulga area, but north and east of the agricultural country, some mulga woodland mixed with mallee scrub is also subject to grazing; the area concerned is about 28,000 square miles, of which about two-thirds is east of the Eastern Goldfields.

The second main grazing area is that of "sclerophyllous grass steppe" (Wood, 1950), "sclerophyll hummock grassland and sclerophyll shrub savannah" (Williams, 1955), "hummock grassland" (Perry, 1958), "hummock grassland and shrub savannah" (Williams, 1959), extending over some 150,000 square miles or about 16 per cent of the State's area, with the exception of the rugged land of the Hamersley Plateau and of the other dissected tablelands to the south. This is an area where faulty grazing methods caused a catastrophic fall in sheep numbers after the pastures had deteriorated over a number of years. The hummocks of *Triodia pungens* are not likely to suffer from grazing, and tend to replace the other plants in the overgrazed areas.

Some intermittent grazing took place along the Canning Stock Route (Map 1) but the movement of cattle along this desert route declined considerably with the improvement of road and port facilities and disappeared even before the introduction of air transport.

Near Roebourne and Port Hedland, Wood (1950) shows over 5,000 square miles of "savannah." Williams (1955) shows nearly 12,000 square miles of "sclerophyll low tree savannah" interrupted by patches of "semi-arid tussock grassland" which amount to some 3,500 miles; these formations go from Roebourne to beyond Anna Plains. Perry (1958) does not recognize these formations in his generalized map. Williams (1959) changes the definition slightly to

"tree and low tree savannah" while retaining the "hummock grassland"; the area remains the same. Grazing, as everywhere further south with the exeeption of the more rugged ground east of the Hamersleys, is by sheep.

The area leased for grazing in the Kimberley region amounts to over 70,000 square miles. Wood (1950) shows it almost equally divided between "grassy scrub" in the west, "savannah woodland" in the north-east, and "savannah woodland and savannah" in the south-east. Williams (1955) shows the western third, from the Christmas Creek basin, to the west and south of the Margaret River, as "sclerophyll shrub savannah"; the north-eastern quarter is "tropical woodland (mixed)"; the south-eastern portion is "low arid woodland and selcrophyll low trec savannah." East of Halls Creek and north of the Fitzroy River are patches of "semi-arid tussoek grassland," some of it mixed with "sclerophyll low trec savannah."

Perry (1958) shows the south-western half as "hummock grassland" and the north-eastern half as "savannah woodland" but encloses small patches of "tussock grassland" both west and east of Halls Creek. Williams (1959) shows the south-western half as "shrub savannah" and the north-eastern half mostly as "low layered woodland with tree and low tree savannah" with a small area of "low layered woodland" in the east and two small areas of "tussock grassland" in the west. The extreme north-east is "woodland."

THE AGRICULTURAL LANDS

The agricultural lands of the State, from Ajana and Yuna to Southern Cross to Lake Varley to Mount Manypeaks, cover some 30,000 square miles. This country has been cleared of its natural vegetation and is used for erops, or lying fallow, or used for grazing. From a naturalist's point of view the main characteristie of it now is the destruction of the natural environment. I am indebted to Miss P. Watson for the computation of the following percentages:

STATE OF NATURAL ENVIRONMENT IN THE AGRICULTURAL DISTRICTS OF WESTERN AUSTRALIA

District	Land in private holdings			Crown land*
	Cleared	Uncleared		
		Grazed	Unused	
	%	%	%	%
Armadale-Kelmscott	15	4	4	76
Cockburn	14	11	6	69
Darling Range	8	2	5	85
Gosnells	16	7	6	70
Kwinana	14	33	6	48
Mundaring	11	6	17	66
Rockingham	13	10	4	73
Serpentine-Jarrahdale	25	9	5	62
Swan (part)	16	8	20	56
Wanneroo	3	24	6	67
SWAN DIVISION	14	10	9	67

* Including forest land, reserves, railway land, buildings, etc.

	%	%	%	%
Augusta-Margaret River	12	9	5	74
Ballngup	21	8	9	63
Bridgetown	29	15	6	50
Bunbury	4	4	—	92
Busselton	31	18	6	45
Capel	43	20	3	33
Collie Coalfields	6	11	7	76
Dardanup	35	17	5	43
Drakesbrook	26	16	2	65
Greenbushes	34	18	12	36
Harvey	16	8	6	70
Mandurah	2	9	2	87
Manjimup	6	6	3	85
Marradong	9	7	5	79
Murray	23	11	6	60
Nannup	3	4	1	9
Preston	30	25	10	35
Upper Blackwood	31	22	13	34
SOUTH-WEST DIVISION	16	11	5	68
Albany	7	6	7	80
Broomehill	80	7	9	4
Cranbrook	18	27	11	44
Denmark	5	4	5	85
Dumbleyung	61	2	14	23
Gnowangerup	22	3	7	68
Katanning	76	6	9	9
Kent	16	1	18	65
Kojonup	49	24	15	11
Lake Grace	20	1	12	67
Plantagenet	22	11	20	47
Tambellup	51	12	20	17
Wagin	68	13	9	10
West Arthur	32	24	18	27
Woodanilling	52	11	12	26
SOUTH. AGR. DIVISION	28	8	11	53
Beverley	57	9	7	27
Brookton*	90	10	13	—
Bruce Rock	80	3	15	2
Corrigin	69	4	9	17
Cuballing	54	8	9	29
Cunderdin	90	6	3	1
Dowerin	72	3	6	19
Goomalling	72	10	7	11
Kellerberrin	81	3	13	3
Kondinin	35	2	15	48
Koorda	42	6	18	34
Kulin	35	2	12	51
Kununoppin—Tr.	69	7	15	10
Merredin	53	3	16	28
Mount Marshall	14	27	7	52
Mukinbudin	31	11	13	45
Narembeen	44	3	22	32
Narrogin	65	8	10	17
Northam	73	9	7	11
Nungarin	52	8	14	26
Pingelly	71	7	10	12
Quairading*	98	6	10	—
Tammin	77	3	6	14

* Includes parts of holdings outside the district.

	%	%	%	%
Toodyay	30	13	6	51
Wandering	20	8	9	63
Westonia	9	8	10	72
Wickepin	75	5	14	5
Williams	36	14	13	37
Wyalkatchem*	92	4	8	—
York	54	6	6	35
CENTRAL AGR. DIVISION	49	9	11	31
Carnamah	26	4	10	60
Chapman Valley	31	14	11	44
Chittering	20	12	25	42
Dalwallinu	23	59	6	12
Dandaragan	9	6	11	74
Geraldton-Greenough	46	22	17	15
Gingin	9	18	11	62
Irwin	10	5	19	65
Mingenew	48	27	12	13
Moora	65	11	13	11
Morawa	47	31	15	7
Mullewa	13	63	6	18
Northampton	6	18	6	70
Perenjori	25	55	9	11
Three Springs	31	6	13	50
Victoria Plains	57	13	14	16
Wongan-Ballidu	75	4	11	10
NORTH. AGR. DIVISION	24	29	9	38

The coastal plain environment has been described by Gardner (1926), Serventy (1948), and in detail with regard to soils by Bettenay, McArthur and Hingston (1960). The closer woodland growing on the clays of the Guildford Association has been cleared over most of the area, and replaced by pastures. Grazing is carried out on more than another 30 per cent of the area north of Harvey, and on less than 30 per cent of the area further south, as far as Boyanup. Grazing of uncleared land becomes more important again from Boyanup to beyond Margaret River. The amount of clearing is more than 50 per cent of the land as far south as Margaret River.

The sandy soils of the Bassendean Association are largely unused, but at Gnangara they have been planted with *Pinus pinaster* which has formed a very dense forest, typically with no undergrowth (Fig. 2).

Many swamps (Serpentine River soil association) have been drained and cleared of their natural vegetation and are now used for potatoes or clover.

The narrow belt of coastal limestone, which supports the typical tuart woodland, has been affected more by human settlement than by grazing or agriculture. The southward spread of beach and holiday resorts with their fishing shacks and beach cabins has modified the environment in yet another way. On the other hand the dune zone, though frequently disturbed, has not had many permanent structures erected upon it, and may be closer to its natural state than the limestone belt now is.

The 7,680 acres set aside as Yanchep Park and the 20,000 acres

* Includes parts of holdings outside the district.

of the Caves Reserves in the South-West ensure that no massive destruction of the limestone environment may take place.* A reserve of 5,000 acres set aside along the Old Coast Road south of Mandurah protects a unique combination of coastal types of environment.

Fig. 2 has been prepared to show the geographical significance of these statistics. The vegetation described by Gardner (1926) as "sclerophyllous woodland" and "savannah woodland" has suffered the most, and has practically disappeared from large areas. Gardner's "wandoo woodland" has been cleared over 30 to 70 per cent of the area, and of the remainder, between 10 and 30 per cent is subject to grazing, which does not affect the arboreal part of the environment but will certainly affect the undergrowth. To the writer's knowledge no reserve has been set aside to protect any sample of this type of environment.

The better forests of jarrah and karri ("dry sclerophyll forest" and "wet sclerophyll forest"' respectively of Wood, 1950; Williams, 1955; Williams, 1959; amalgamated as "sclerophyll forests" by Perry, 1958) are reserved by the Crown and protected very effectively. Cutting is selective, and the natural environment is never drastically affected over large areas simultaneously, although marri is usually spared while jarrah and blackbutt are cut. The forests found within the water catchment areas (Mundaring, Canning, Wongong, Serpentine and catchments for irrigation further south) were cut over within the last century, and now consist of second or third growth, but it seems likely that the natural environment has not changed greatly, because the regeneration of the forest was allowed to proceed completely undisturbed. Serventy (1948) points out that the widespread occurrence of plants poisonous to sheep, especially of the York-road poison *(Gastrolobium calycinum)*, delayed and in many places prevented the "development" of this type of environment for grazing, especially in the earlier days when nothing was done to protect the forests.

Typical jarrah forests are wholly protected in the Forrest National Park (5,000 acres) in the north, and in the Collie parklands (1,000 acres) in the south. Karri forests have been included in the reserves at Pemberton (9,700 acres) and at Nornalup (33,000 acres). Small reserves north of Albany amount to 5,700 acres, and protect a mixture of forest and woodland environments. The Porongorup Reserve (5,400 acres) protects a small outlier of karri, much farther east than its usual range.

From Wanneroo to Dongara and also east of Mount Barker, Ongerup and Pingrup are large expanses of heath, floristically extremely interesting (Gardner, 1926), which constitutes a very distinct type of environment, and which is still unused because its soil does not support any economic crop. Scientific discoveries have now made the utilization of these soils quite possible, and it is to be hoped that suitably large and representative parts of this environment be set aside as National Parks before it is too late. In the

* Vandalism due to inadequate protection does occur within the caves, when unauthorised persons gain access to them.

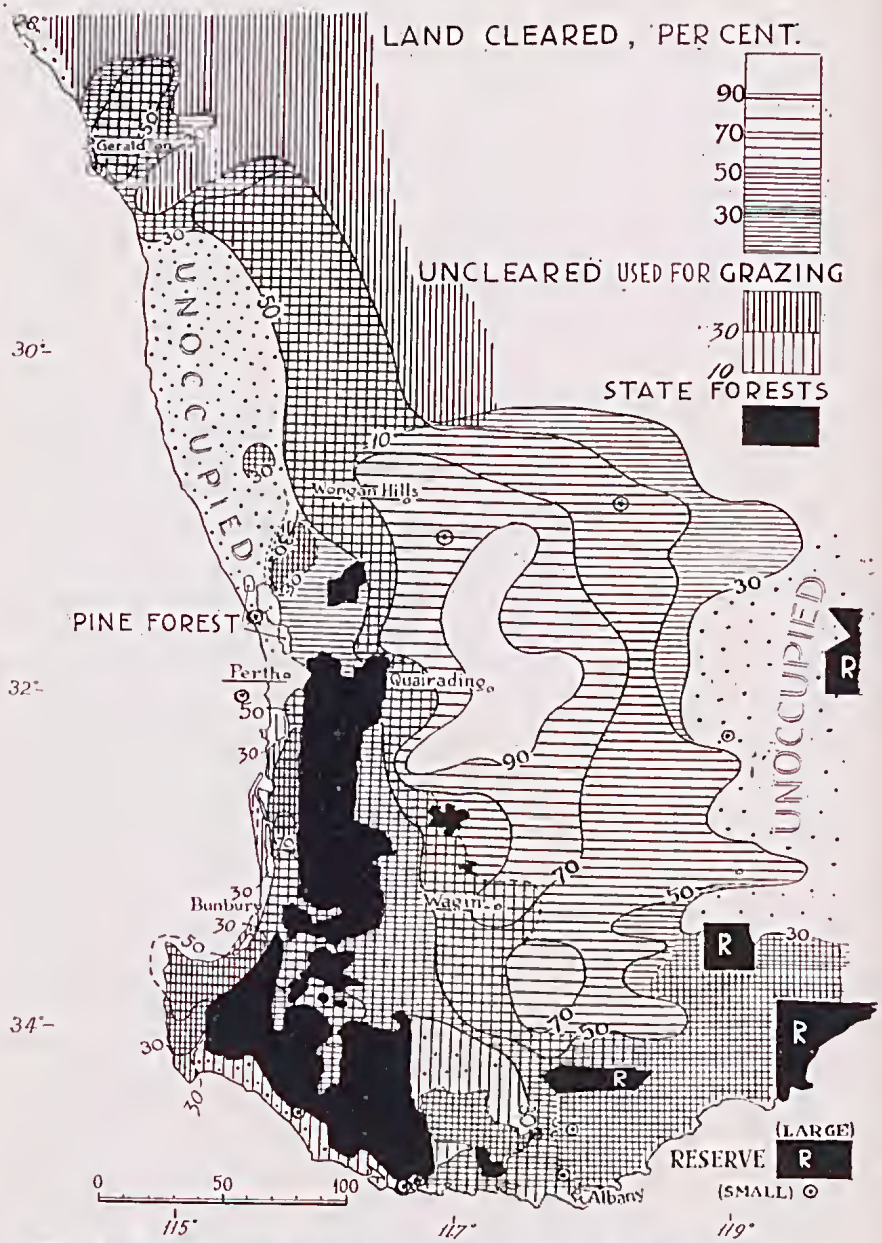

Fig. 2.—Modification of the natural environment in the agricultural areas.

southern area the Bremer Bay Reserve protects 604,670 acres of heath country.

It is probably too late to save any typical area of the central sclerophyllous woodland (salmon gum and gimlet woodland) but large areas of its drier variant still exist east of Southern Cross, and one of these not far from Southern Cross (Parkers Range-Jilbadgi) has been given a legal status as a reserve (Fig. 2).

Finally, it should be stressed that effective conservation of the natural environment must control grazing and fire in the most efficient way. Uncontrolled and prolonged grazing is most harmful because it cannot fail to be selective, thus affecting the natural balance and changing the specific composition of the plant cover. The soil structure is affected by trampling. Fire may help the regeneration of some plant species which need it to start the seed germinating, but repeated fires are undoubtedly very harmful, and they too have a selective effect. Good forest stands are well preserved as areas of natural environment for the very simple reason that they are well protected because of their economic value. The cost of keeping some 20 rangers in charge of the most representative nature reserves in the State should not prove beyond the resources of Western Australia's fast expanding economy, and, in view of the rapid development of tourism, this cost may well become a far-sighted economic investment.

SUMMARY

A study of land utilization in Western Australia shows that more than half the area is still unoccupied, and one-third of the remainder is leased for grazing. An analysis of vegetation maps, which show the main types of natural environment, discloses that most of the unoccupied area belongs to very few types of environment, among which the desert predominates. The land used for grazing has undergone changes in the balance of nature which may by now be permanent; the effect of grazing is far more drastic than was believed in the past, and this is why the setting aside of suitably large areas as nature reserves became so urgent in recent years. A detailed review is made of the agricultural lands, which have been extensively cleared, in some districts up to 90 per cent of the total area, as is shown by the map. It is feared that no typical salmon gum and gimlet country, no typical York gum and jam country may be saved now. No representative area of wandoo woodland has been reserved so far. Water catchments and forest reserves have ensured the conservation of forest environments. Small reserves badly in need of protection should ensure the survival of some of the coastal landscapes, but unless a small force of trained rangers is made available, the simple gazetting of reserved areas will not achieve its aim in the settled districts.

BIBLIOGRAPHY

Official publications:

Year Book of the Commonwealth of Australia. 1959.
Official Year Book of Western Australia. 1957.
Statistical Register of Western Australia. 1957-58.
Atlas of Australian Resources. 1953-60.

BETTANAY, E., W. M. McARTHUR and F. J. HINGSTON. 1960. *The Soil Associations of Part of the Swan Coastal Plain, Western Australia.* Soils and Land Use Series No. 35, C.S. & I.R.O.
EALEY, E. H. M., and H. SUIJENDORP. 1959. Pasture management and the Euro problem in the North-West. *J. Dept. Agr. W.A.* (ser. 3), 8 (3): 273-286.
GARDNER, C. A. 1926. The salient features of the plant geography of extra-tropical Western Australia. In *Science in Western Australia.* Perth.
GENTILLI, J. 1941. *Atlas of Western Australian Agriculture.* Perth.
GENTILLI, J. 1958. Australien—Landwirtschaft, Viehzucht und Fischerei. Map in *Grosser Herder Atlas.* Freiburg.
PERRY, R. A. 1958. Australien—Vegetation. Map in *Grosser Herder Atlas.* Freiburg.
SERVENTY, D. L. 1948. The birds of the Swan River district, Western Australia. *Emu,* 47 (4): 241-286.
WILCOX, D. G. 1960. Studies in the mulga pastoral zone, parts 1 and 2. *J. Dept. Agr. W.A.* (ser. 4), 1: 475-479, 581-586.
WILLIAMS, R. J. 1955. Vegetation regions. Map in *Atlas of Australian Resources.* Canberra.
WILLIAMS, R. J. 1959. Vegetation map of Australia. In *The Australian Environment.* C.S. & I.R.O.
WOOD, J. G. 1950. Vegetation map of Australia. In *The Australian Environment.* 1st ed. C.S. & I.R.O., Melbourne.

FROM FIELD AND STUDY

Psilotum nudum **at the Murchison River.**—On August 24, 1960, R. J. Butler collected a fruiting specimen of the primitive pteridophyte, *Psilotum nudum* (Linn.) Grisch. = *Psilotum triquetrum* Swartz., from Pine Thicket Gorge on the Murchison River south of Galena. The specimen was found growing in a crevice in a sandstone cliff face and about 20 ft. above the high water mark of the river.

The geographical distribution of *Psilotum nudum* is pan-tropical with extensions into both northern and southern moist subtropical regions. In Australia it extends from northern Queensland into the coastal and mountainous regions of New South Wales and occurs again in rocky areas of the Grampians in Victoria. In Western Australia it is only known from a collection made by W. V. Fitzgerald in 1905 from the Sprigg and Charnley Rivers in the West Kimberley.

The Butler collection is noteworthy as being the more southerly known occurrence of *Psilotum nudum* in Western Australia.

—G. G. SMITH and R. J. BUTLER, Nedlands.

Kangaroo Bot Fly Larva from Port Hedland.—A single larva of the Kangaroo Bot Fly, *Tracheomyia (Oestrus) macropi* Frog. (Diptera: Oestridae), was submitted for identification by Mr. R. M. Sadleir of the Zoology Department, University of Western Australia. The specimen was collected on August 16, 1960, in the mouth (between the two bottom incisors and under the tongue) of a female red kangaroo (*Macropus rufus* Desmarest) at Mundabullangana Station (managed by Mr. R. Lukis), at Port Hedland, W.A.

The Kangaroo Bot Fly was named as such and the larvae de-